

1 F73

1/4 32, 1942

**TM 9-1225**

**U.S. WAR DEPARTMENT**

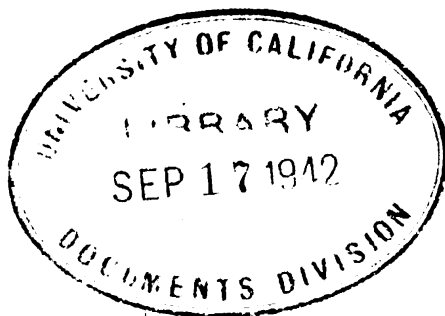
**TECHNICAL MANUAL**



**ORDNANCE MAINTENANCE**

**BROWNING MACHINE GUN,  
CALIBER .50, ALL TYPES**

**June 12, 1942**





# ORDNANCE MAINTENANCE—BROWNING MACHINE GUN, CALIBER .50, ALL TYPES

CHANGES }  
No. 1 }

U15 WAR DEPARTMENT,  
WASHINGTON 25, D. C., 1 July 1943.

TM 9-1225, 15 April 1943, is changed as follows:

## 63. Miscellaneous.

\* \* \* \* \*

*g. Removal of oil and parts from oil buffer M2, heavy-barrel gun.*

(1) (Superseded.) Some heavy-barreled machine guns have been found to operate sluggishly, due to insufficient reserve energy. The insufficient reserve energy may be caused by lack of lubrication, burred parts, or by the action of the oil buffer mechanism in the gun. If a heavy-barreled gun delivers the normal rate of fire (400 to 500 rounds per minute), the gun may be considered in good operating condition. If sluggish operation or stoppages are encountered, disassemble the gun and inspect all moving parts for rough surfaces, burs, or insufficient lubrication. If any of these conditions are found, they must be corrected. If the gun still operates sluggishly or if stoppages occur, the oil and the following parts (fig. 74) should be removed from the oil buffer:

Piece mark	Item	Quantity
A9279A -----	PACKING, oil buffer gland-----	1
A9297-----	RING, oil buffer packing gland-----	1
A9360-----	SCREW, oil buffer relief valve-----	1
A9299-----	SPRING, oil buffer packing gland-----	1
A9393-----	SPRING, oil buffer relief valve-----	1
A9528-----	VALVE, relief, oil buffer-----	1

NOTE.—Previous instructions (par. 2, TB 1225-13) have directed removal of the oil buffer tube filler screws A9361. These screws are needed to prevent dirt and other extraneous matter from entering the oil buffer tube. Therefore, all oil buffers from which the screws have been removed should be cleaned and the screws replaced. This change supersedes information on this point in paragraph 2, TB 1225-13.

\* \* \* \* \*

[A. G. 300.7 (17 Jun 43).] (C 1, 1 Jul 43.)

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,  
*Chief of Staff.*

OFFICIAL:

J. A. ULIO,  
*Major General,  
The Adjutant General.*



✓

*Technical Manual*

TM 9-1225

C 2

ORDNANCE MAINTENANCE

BROWNING MACHINE GUN CAL. .50, ALL TYPES

No. 2 }  
CHANGES }

USWAR DEPARTMENT

WASHINGTON 25, D. C., 5 September 1943.

TM 9-1225, 15 April 1943, is changed as follows:

31. Head space adjustment and checking.

*b. Adjustment for caliber .50, M2 aircraft machine guns.*—The following instructions apply to caliber .50, M2 aircraft machine guns only:

(1) Pull the bolt back about 1 inch by means of the bolt handle or the extractor.

(2) Screw the barrel into the barrel extension (by applying a screw driver to the notches on the rear end of the barrel) until the recoiling parts will not go into battery position without being forced when the bolt is released. The recoiling parts are in battery when the barrel extension touches the trunnion block.

NOTE.—For ease in screwing the barrel into the barrel extension, remove the rear right-hand cartridge stop assembly.

(3) Screw barrel out of the barrel extension one notch at a time until the recoiling parts will just go into battery position when the bolt is released but is not forced forward.

NOTE.—Do not retract the bolt more than 1 inch when determining the point at which the recoiling parts will just go into battery position without being forced.

(4) When this point is found, retract the bolt and unscrew the barrel TWO more notches.

*c. Adjustment for caliber .50 M2 heavy barrel machine guns.*—Head space adjustment is made without removing working parts from the casing. To head space the caliber .50 HB, M2 gun, screw barrel by hand into barrel extension until it comes into contact with bolt. Check to make sure end of barrel extends through barrel extension. Then unscrew barrel two notches. If gun operates sluggishly, unscrew barrel one additional notch.

*d. Adjustment for caliber .50, M2 water-cooled machine guns.*—

(1) Raise the cover and retract the bolt about  $\frac{1}{2}$  inch (no more),

(2) Screw the barrel into the barrel extension (by applying a screw driver to the notches on the rear end of the barrel) until the barrel comes into contact with the bolt.

(3) Check to make sure end of barrel extends through barrel extension.

(4) Then unscrew the barrel TWO notches.

(5) If the gun operates sluggishly, unscrew barrel one additional notch.

Subparagraphs *c*, *d*, and *e* are renumbered *e*, *f*, and *g*, respectively.

[A. G. 300.7 (2 Aug 43).] (C 2, 5 Sep 43.)

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,  
*Chief of Staff.*

OFFICIAL:

J. A. ULIO,  
*Major General,*  
*The Adjutant General.*

**ORDNANCE MAINTENANCE**
**BROWNING MACHINE GUN, CALIBER .50, ALL TYPES**

<b>SECTION I. General.</b>	<b>Paragraph</b>
Scope.....	1
Description.....	2
Characteristics.....	3
<b>II. Inspection.</b>	
Tools.....	4
General instructions.....	5
Gun as a unit.....	6
Sights.....	7
Water jacket.....	8
Side plate trigger.....	9
Retracting slide or operating slide.....	10
Cover group.....	11
Back plate.....	12
Bolt group.....	13
Barrel extension group.....	14
Oil buffer group.....	15
Receiver group.....	16
Barrel.....	17
Headspace gaging.....	18
Checking timing.....	19
<b>III. Maintenance and repair.</b>	
Tools.....	20
General instructions.....	21
Burs on screw heads and smooth surfaces.....	22
Loose rear sight movable base pivot or tension spring stud.....	23
Loose rear sight fixed base.....	24
Front sight out of alinement.....	25
Water jacket.....	26
Cover extractor cam.....	27
Side plate.....	28
Bent trigger bar.....	29
Clogged steam tube.....	30
Bent belt feed lever or worn stud.....	31

\*This manual supersedes TM 9-1225, January 5, 1942.

SECTION III. Maintenance and repair—Continued.

	Paragraph
Excessive play between sear and sear slide.....	32
Packing barrel.....	33
Mounts.....	34
Care, cleaning, and lubrication.....	35

APPENDIX. List of references.....	Page 24
-----------------------------------	---------

SECTION I

GENERAL

	Paragraph
Scope.....	1
Description.....	2
Characteristics.....	3

1. **Scope.**—This manual is published for the information and guidance of ordnance maintenance personnel. It contains detailed instructions for the inspection, maintenance, and repair of the following Browning machine guns:

- Caliber .50, M1921, aircraft, fixed and flexible.
- Caliber .50, M1921 and M1921A1, water-cooled.
- Caliber .50, M2, aircraft, fixed and flexible.
- Caliber .50, M2, aircraft, basic.
- Caliber .50, M2, water-cooled, flexible.
- Caliber .50, M2, heavy barrel, fixed and flexible.

These instructions are supplementary to information given in the Field Manuals and Technical Manuals prepared for the using arm. The information given with respect to the guns is treated as a single set of instructions applicable to all models of this weapon listed above. Items which do not apply to the particular model in question will therefore be disregarded.

2. **Description.**—*a. M1921, aircraft, fixed and flexible types* (fig. 1).—This gun was originally designed solely for use as a fixed synchronized gun for aircraft, with feed from left side only. Description and information on disassembly and assembly are contained in TM 9-220.

*b. M1921, water-cooled.*—This water-cooled gun was originally designed for use with antiaircraft machine gun tripod mount, caliber .50, M1. There are none of these guns in the hands of the Army as all such weapons have been modified to the M1921A1 type. There are, however, a large number of M1921 guns in use in the Navy.

*c. M1921A1, water-cooled* (fig. 4①).—This gun is a modification of the M1921 water-cooled machine gun. It is now used with the antiaircraft tripod mount, caliber .50, M1.

*d. M2, aircraft, fixed and flexible types (fig. 2).*—These guns are air-cooled and can be mounted fixed or flexible in aircraft. The fixed type gun is furnished with an operating slide for hand operation, and a back plate having a horizontal (or vertical) buffer. The gun is fired by a trigger motor and synchronizing mechanism. The flexible type gun is furnished with a retracting slide for hand operation, and a back plate having a horizontal buffer, double spade grips, and a hand trigger. Sights for this gun are carried as airplane equipment.

*e. M2, aircraft, basic (fig. 3).*—This gun may be described as a Browning machine gun, caliber .50, M2, aircraft, fixed, from which the operating slide group assembly has been removed and to which a trigger bar and trigger bar pin assembly have been added. This gun can be made into either the fixed or flexible type by the addition of an operating slide group assembly (for the fixed type) or a retracting slide group assembly (for the flexible type). The fixed type of gun obtained by adding an operating slide group assembly to a basic type of gun differs from the Browning machine gun, caliber .50, M2, aircraft, fixed, by having a trigger bar and trigger bar pin assembly, whereas the latter gun does not.

*f. M2, water-cooled, flexible (fig. 4②).*—As a flexible antiaircraft weapon this gun can be used with the antiaircraft machine gun tripod mount, caliber .50, M1, or with the antiaircraft machine gun mount, caliber .50, M2. The latter mount is normally assembled with tripod legs, and designated as antiaircraft machine gun tripod mount, caliber .50, M2. By removing tripod legs and assembling a pedestal base, the mount may be placed on decks or other permanent positions, and is then designated as antiaircraft machine gun pedestal mount, caliber .50, M2. This gun is used as a fixed antiaircraft weapon when mounted in the cradle of the 37-mm gun on antiaircraft gun carriage M3E1. Two machine guns, caliber .50, M2, water-cooled, are mounted rigidly in the cradle, one on each side of the 37-mm cannon. Until recently all guns of this type were provided with spade grips on the back plate. However, Browning machine guns, caliber .50, M2, water-cooled, flexible, now being supplied are provided with back plates which have triggers and trigger safeties but no spade grips. The spade grips were eliminated because they were inconvenient when the gun was used on the M2 antiaircraft machine gun mount. This gun can be used with a 36-inch or a 45-inch barrel. All Browning machine guns, caliber .50, M2, water-cooled, which are now in service, except about 390, are of the 45-inch barrel type.

*g. M2, heavy barrel, fixed and flexible types (fig. 5).*—These guns are air-cooled, and can be mounted in combat vehicles, or used as a

ground gun mounted on the machine gun tripod mount, caliber .50, M3. The main difference between this gun and other types of caliber .50, M2 guns is in the barrel, and oil buffer assembly. The barrel of the gun need not be removed to adjust headspace, but must be removed before withdrawing the oil buffer and barrel extension assemblies. In the oil buffer of this gun the piston valve and piston valve key are omitted. The reason for this is that the heavy barrel does not recoil with as much force as the lighter barrels of the other M2 machine guns. Omitting the piston valve and key allows the oil to pass more freely through the openings in the oil buffer piston rod head, offering less resistance to the recoil.

**3. Characteristics.**—All M1921 type guns are for left-hand feed only. M1921A1 water-cooled guns cannot be used in the caliber .50 antiaircraft machine gun mount M2. All types of Browning machine guns, caliber .50, M2, are alterable as follows:

a. Ammunition can be fed from left or right side by repositioning of the parts pertaining thereto.

b. Operating and retracting slides can be changed from right to left side of receiver by repositioning and changing the parts pertaining thereto.

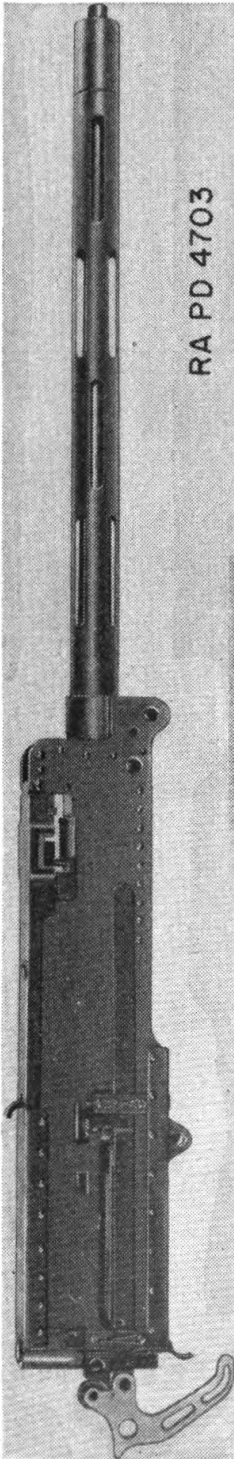
c. Guns can be converted from fixed to flexible (and vice versa) by changing of parts concerned.

d. The buffer can be changed from horizontal to vertical by replacing backplate with one having vertical buffer assembly.

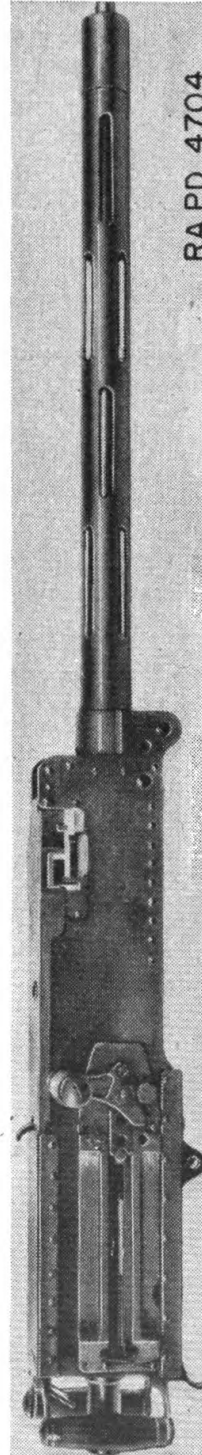
e. The water jacket of the water-cooled gun, the barrel support of the heavy barrel gun, and the trunnion adapter of the aircraft gun may be quickly assembled to the receiver without thread qualification, through use of a trunnion block shim. These shims, numbered from 1 to 12, differ in thickness by 0.0025 inch; number 1 shim is 0.0585 inch thick. Upon original assembly of the machine gun at place of manufacture, the shim of correct thickness is assembled and the number of that particular shim and the next three higher numbers are marked on the side plate and the rear end cap, trunnion adapter, or barrel support. These three next higher numbered shims accompany the machine gun as a thicker shim may be required later.

**NOTE.**—In order that the parts of the machine gun may be readily identified, all components which are of sufficient size are marked to show the drawing and last revision number; for example, the belt feed lever would be marked C-4057-2. Parts which are too small to permit use of the full drawing number are marked to show the last revision, for example, -2.

f. The driving spring assembly of caliber .50, M2 guns (all types) has been modified, and is now composed of a double spring (inner and outer) assembled with modified driving spring rod assembly.

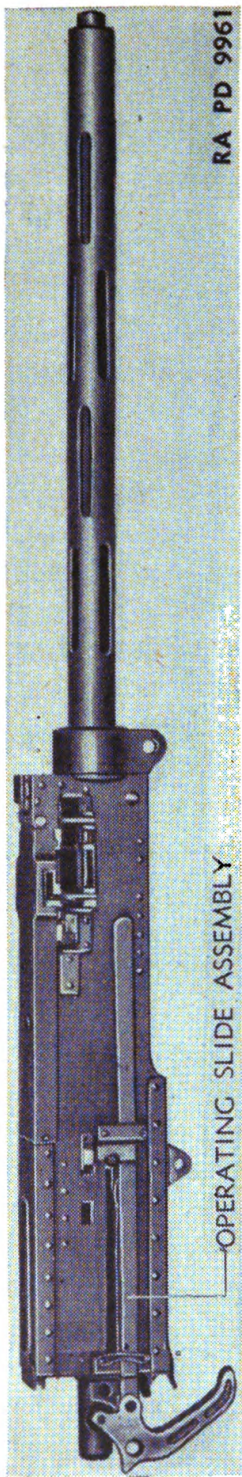


① Aircraft, M1921, fixed.

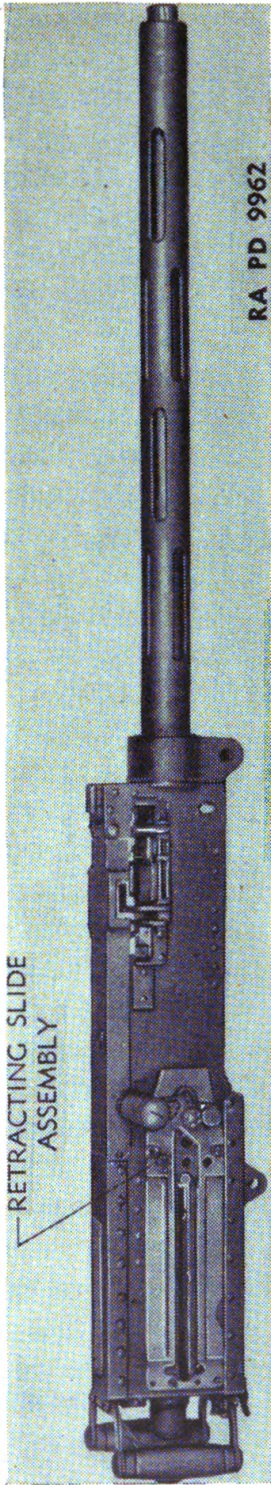


② Aircraft, M1921, flexible.

FIGURE 1.—Types of caliber .50 Browning machine guns, aircraft.



① Aircraft, M2, fixed.



② Aircraft, M2, flexible.

FIGURE 2.—Types of caliber .50 Browning machine guns, aircraft.

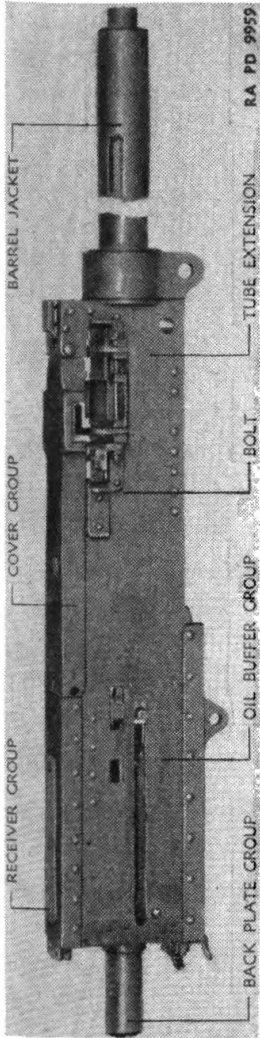
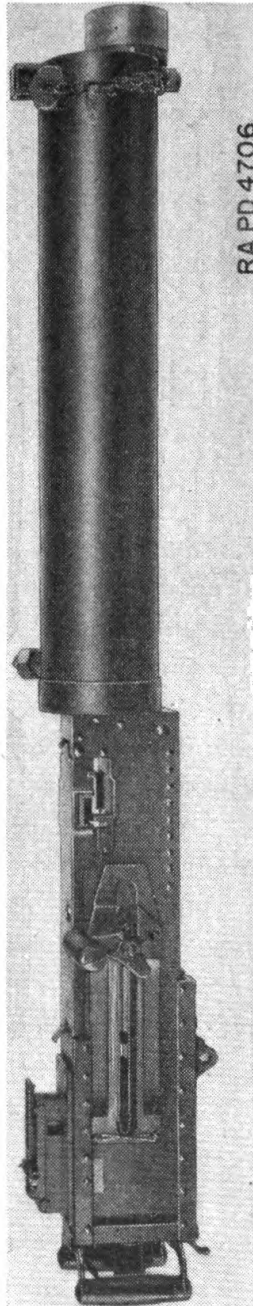
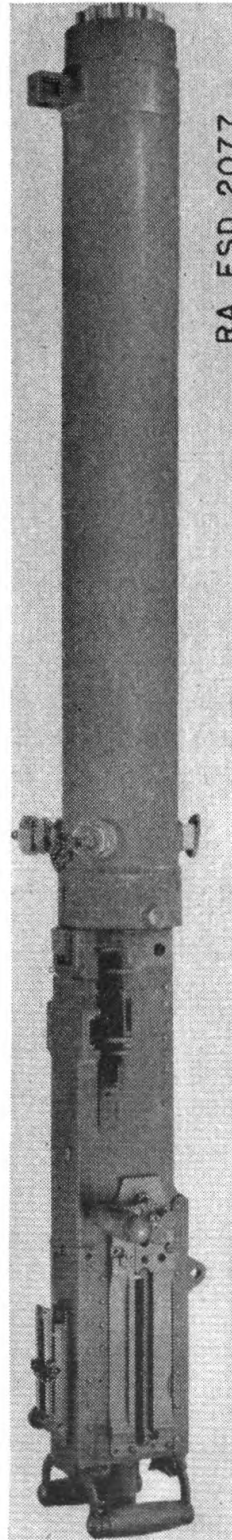


FIGURE 3.—Browning machine gun, caliber .50, M2, aircraft, basic.

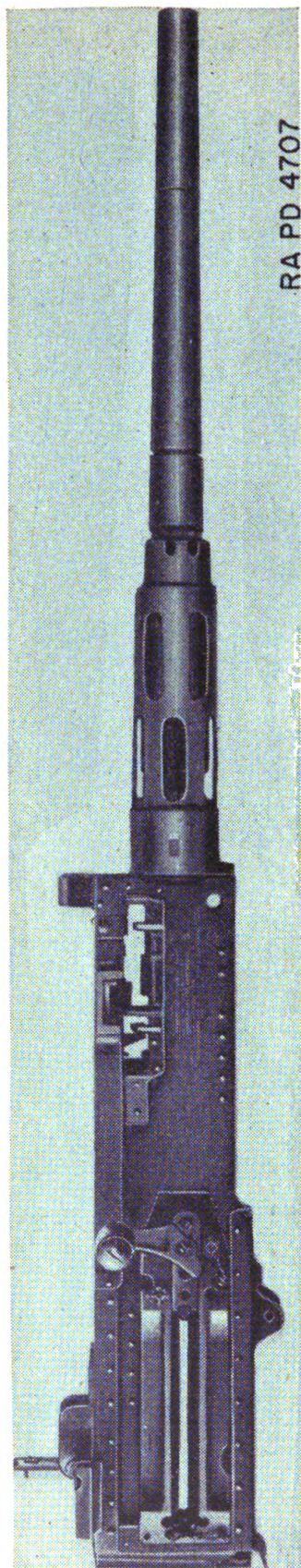


① M1921A1.

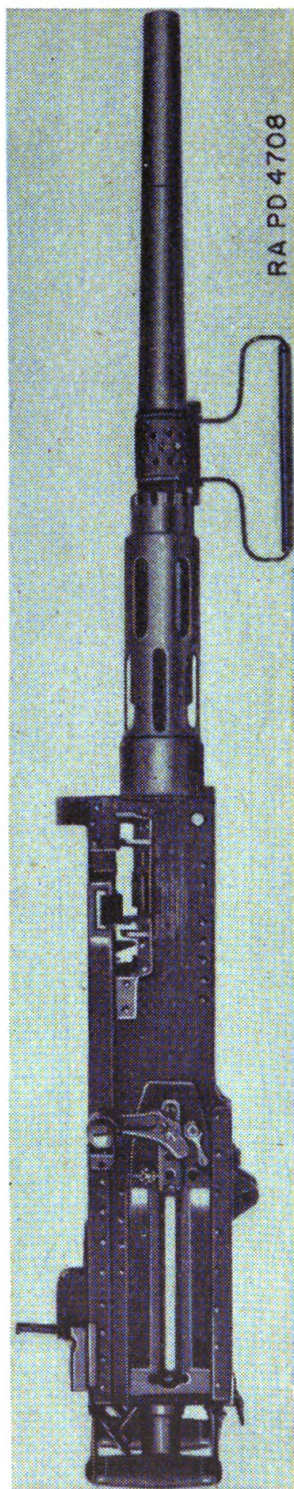


② M2, flexible.

FIGURE 4.—Types of caliber .50 Browning machine guns, water-cooled.



① Heavy barrel, M2, fixed.



② Heavy barrel, M2, flexible.

FIGURE 5.—Types of caliber .50 Browning machine guns, heavy barrel.

## SECTION II

### INSPECTION

	Paragraph
Tools.....	4
General instructions.....	5
Gun as a unit.....	6
Sights.....	7
Water jacket.....	8
Side plate trigger.....	9
Retracting slide or operating slide.....	10
Cover group.....	11
Back plate.....	12
Bolt group.....	13
Barrel extension group.....	14
Oil buffer group.....	15
Receiver group.....	16
Barrel.....	17
Headspace gaging.....	18
Checking timing.....	19

**4. Tools.**—General tools for inspection are listed in the SNL pertaining to the matériel in question. Special tools are listed in SNL A-35. All are to be taken from the small arms repair truck. The following describes the use of special tools:

*a. Gage, breech bore (C20623).*—The bore gage is used for measuring the advancement of the bullet seat in the barrel to determine the serviceability. The complete unit consists of an assembly made up of a gage, sleeve, knob, and taper pin. The gage is provided with index lines graduated in tenths of an inch for a distance of 4 inches. The maximum bullet seat in a new barrel is indicated when the zero line on the gage is alined with the long side of the sleeve. The gage is provided with a red index line at the 2.0-inch mark. When the red index line is alined with the sleeve, the barrel is considered unserviceable. No special care is required beyond that normally given to gages, such as rust prevention and protection from nicks and burs.

*b. Gage, firing pin hole, .084 inch (A77200).*—The firing pin hole gage is used to determine the serviceability of the bolt.

*c. Gage, headspace and timing (A196228).*—The headspace and timing gage is used to check proper headspace and timing of firing mechanism.

*d. Reflector, barrel, inspector's (C64255).*—The inspector's barrel reflector is used for the visual inspection of the bore.

*e. Wrench, combination, caliber .50, M2.*—This is a special tool used for disassembling, assembling, and making adjustments of the guns. Each opening and projection is marked to show its purpose.

**5. General instructions.**—Inspection is for the purpose of determining the condition of the matériel, whether repairs or adjustments are required, and the remedies necessary to insure that the matériel is in serviceable condition. Before inspection is begun, the matériel should be properly cleaned to remove any grease, dirt or other foreign matter which might interfere with its proper functioning. For instructions on cleaning the guns see FM 23-60, FM 23-65, and TM 9-850. For instructions on disassembling and assembling of the matériel listed above see section III. For the purpose, technique, frequency and reports required in inspection see OFSB 4-1 or TM 9-1100. A list of the points to be checked, arranged in the order of inspection, and necessary instructions for making the inspection are given below.

**6. Guns as a unit.**—Check general appearance. Note smoothness of operation by pulling retracting (operating) slide to rear and releasing. Check headspace adjustment; raise cover and extractor and move bolt slightly to rear by means of retracting (operating) slide. If bolt moves independently of the barrel, the headspace adjustment needs tightening. There must be no rearward movement of the bolt independent of the barrel prior to the unlocking of the breech. See the Field Manuals and Technical Manuals (on the gun) listed in the appendix for adjustment of headspace and paragraphs 18 and 19 for headspace gaging and timing. Examine barrel packings for indication of leaks. Check for burs, also loose barrel jacket, missing front barrel bearing screw, looseness of barrel support, missing cotter pins and broken lock wires.

**7. Sights.**—*a. Front sight.*—Check for loose front sight, alinement of front sight blade, and loose or bent front sight cover.

*b. Rear sight.*—Check for loose or missing rear sight fixed base screws, excessive friction in windage screw, tension of windage screw spring (M1921A1 water-cooled), play in rear sight movable base, and functioning of rear sight aperture disk, half nut, and elevating screw. Check for loose rear sight movable base pivot, missing rear sight slide cap screws, bent rear sight slide, and tension of rear sight leaf spring. Check for missing or loose rear sight base screws, burs on telescopic sight dovetail, tension of telescopic sight clamp spring, and functioning of rear sight half nut, elevating screw and windage screw.

**8. Water jacket.**—Check alinement; trunnion block lock should be positioned in rear end cap (M2 gun). Test functioning of water jacket drain valve (water plug M1921 gun). Inspect for leaks, burred threads in reducing bushings, loose front sight base, burred threads on front end cap, missing front end cap thread cover, missing or loose

front barrel bearing lock screw jam nut (M2 gun) and loose front barrel bearing lock screw jam nut (M2 gun) and loose front barrel bearing lock screw (M2 gun). Remove muzzle gland (M1921 gun) and check for burred threads. Remove muzzle radiator (M1921A1 gun) and check for damaged threads, carbon in bushing and radiator vents, loose or missing bushing lock screw, and missing or damaged lock washer. Inspect front and rear barrel packings but do not remove except for replacement. Do not remove steam tube unless necessary. To test functioning of outer steam tube, tip up water jacket and listen for sliding of tube. To remove steam tube assembly from water jacket refer to paragraph 30.

**NOTE.**—For liquid filler for water jackets in cold climates refer to paragraph 35.

**9. Side plate trigger.**—Inspect for loose side plate trigger and burs. Check tension of side plate trigger slide spring, and functioning of side plate trigger cam.

**10. Retracting slide or operating slide.**—*a. Retracting slide.*—Inspect for loose retracting slide nuts, loose or missing retracting slide bracket screws (the short screw should be located in the rear lower hole). Check for burs on retracting slide, guideway or retracting slide bracket, and cam surface of retracting slide lever. Test tension of retracting slide lever spring (lever should always return to vertical position). Check for missing or weak retracting slide plunger spring.

*b. Operating slide.*—Inspect for loose or missing operating slide guide screws, straightness of operating slide bar, burs on bar, roller, and front and rear guides, loose operating slide hook, weak or missing operating slide springs. Test functioning of operating slide handle plunger.

**11. Cover group.**—Test tension of cover detent pawl spring and cover latch spring. Check smoothness of operation of cover latch, burs on cover latch, weak or missing cover extractor spring, weak belt feed lever plunger spring (if gun is assembled for left-hand feed, the rear end of the belt feed lever should position itself on the left-hand side). Check for cracked or burred cover extractor cam, tension of belt feed pawl spring, burred or bent belt feed pawl arm, bent belt feed lever, burred lug, bent or missing belt feed pawl arm pin or belt feed pawl arm locating pins.

**12. Back plate.**—Inspect for loose buffer adjusting screw and buffer plate. Buffer plate should project beyond front surface of back plate sufficiently to take the shock of the bolt in recoil. Projection should be approximately 0.187 inch. Test action of backplate latch, latch lock, and oil buffer index finger. (For adjustment and repair of backplate buffer, see par. 26, FM 23-60.)

**13. Bolt group.**—*a.* Inspect for burred or bent bolt stud, bent driving spring rod, burs on driving spring rod head, bent or burred driving spring rod retaining pin. Test tension of driving spring (or springs). For the purpose of comparison the free lengths of driving springs are given below:

M1921 and M1921A1 guns (A9354).....	inches..	24.75	—	.50
M2 gun (all types) (B8932).....	do....	17.00	±	.375
M2 gun (all types) double driving springs:				
Inner spring (C147510) .....	do....	19.50	±	.25
Outer spring (C147509) .....	do....	25.00	±	1.00

*b.* Check firing pin hole in face of bolt, using firing pin hole gage (A77200). Hole should not exceed 0.083 inch in diameter. If gage enters hole, the bolt should be scrapped. Check protrusion of firing pin and replace firing pin if protrusion is less than  $\frac{1}{16}$  inch. Test tension of firing pin spring. Free lengths of firing pin springs for the M1921, M1921A1, and M2 guns are given below:

Old spring (all types) (A9353)				
.050 inch diameter wire.....	inches..	4.70	±	.06
New spring (all types) (A9353)				
.059 inch diameter wire.....	do....	3.22	±	.06

*c.* Inspect for bent or burred cocking lever, bent sear stop pin, burs on sear slide, and smoothness of cam surfaces. Check for excessive play between sear and sear slide. Test tension of sear spring. Check for burs on sear, smoothness of cam surface, sharpness of sear notch and sharpness of sear notch of firing pin extension. Check for broken lip of T-slot. Check for wear in T-slot and recessed face of bolt.

**14. Barrel extension group.**—Inspect for burs and rust, smoothness of operation of breech lock cam, missing breech lock pin spring, straightness and looseness of barrel extension shank, and worn barrel threads. Remove barrel locking spring, screw extension onto barrel, and try for undue looseness. Test for weak barrel locking spring and examine lug for burs and wear. Heavy barrel type guns should have a barrel locking spring stamped B8908-3, or later revision.

**15. Oil buffer group.**—Test tension of oil buffer body spring lock, and tension of oil buffer tube lock spring. Check for worn oil buffer tube lock spring stud and bent or burred breech lock depressors. Test action of accelerator, and check for burs. Test tension of oil buffer spring (B9832—free length  $6. \pm .25$  inches). Check for burred oil buffer spring guide and missing key. Remove oil buffer tube cap, pour out oil and inspect inside of oil buffer tube for evidence of corrosion due to use of wrong kind of recoil oil. Check for straightness

of oil buffer piston rod, burs on oil buffer piston rod head, missing or burred oil buffer piston valve. (There is no oil buffer valve or key in oil buffer of M2, heavy barrel guns, except where HV ammunition is used.) Test function of oil buffer relief valve. Check for loose oil buffer packing gland plug and for oil leaks. When reassembled be sure that oil buffer tube is filled with oil. The correct oil to use is machine gun recoil oil. For kind of oil to use in cold climates see TM 9-850. For method of filling the oil buffer, see section V, TM 9-226.

**16. Receiver group.**—Test tension of switch spring and action of switch. Check for burs on switch and cam surface of breech lock cam. Check breech lock cam screw for staking and looseness (breech lock cam should float slightly). Look for foreign matter under cam. Test tension of belt holding pawl spring. Check for burred or bent belt holding pawl, bent belt holding pawl pin, and missing or broken belt holding pawl pin spring. Check for missing, burred, or improperly assembled cartridge stops (position is stamped on stops), burred or worn link stripper, and loose or missing rivets and bolt stop. Check for cracked side plate at union with back plate. Check trigger bar for deformation and burs.

**17. Barrel.**—Inspect barrel as a whole and from the standpoint of serviceability. Check barrel locking notches for wear or breakdown. (This is very important, for worn or damaged notches may allow barrel to turn while in use, thus causing headspace adjustment to vary.) Inspection of barrels for serviceability will in general be based on accuracy, and inspectors will be guided by this requirement. Accuracy is reduced in varying degrees by bulges, erosion, and pits. The extent to which these defects reduce accuracy is determined by two methods, namely, visual inspection and bore gaging. Before any attempt is made to inspect a barrel for serviceability, metal and all other fouling should be removed and the bore wiped dry.

*a. Visual inspection.*—(1) Hold the barrel so that its interior is illuminated, and examine the bore from the muzzle and breech.

(2) If the barrel is not bent or otherwise deformed and the bore appears free from bulges and pits, and the lands are sharp and uniformly distinct, it is serviceable.

(3) If the bore contains small pits but has sharp and uniformly distinct lands, and is free from bulges and not otherwise deformed, it is serviceable.

(4) Examine the breech end of the bore. If the lands are worn away so that the first 6 or 8 inches of the bore are smooth, the barrel is unserviceable and should be scrapped.

(5) If the barrel contains a bulge, it is unserviceable and should be scrapped. This condition is indicated by a shadowy depression or dark ring in the bore and may often be noticed through a bulge or raised ring on the barrel surface.

(6) If the barrel is pitted to the extent that the sharpness of the lands is affected, or if it has a pit or pits in the lands or grooves large enough to permit the passage of gas past the bullet, that is, a pit the width of a land or groove and  $\frac{1}{2}$  to  $\frac{3}{4}$  inch or longer, it is or soon will be too inaccurate for serviceability and should be scrapped. This condition indicates that proper care of the barrel in accordance with methods prescribed in TM 9-850 has not been taken.

*b. Bore gaging.*—Each barrel inspected and found serviceable by visual test will be bore gaged.

(1) Remove the barrel from the gun in the usual manner and thoroughly clean the bore and chamber. Examine the breech bore gage (A20623) to insure that it is clean and moves freely in the sleeve. The presence of dirt, foreign matter, or any other obstruction will prevent the sleeve from seating properly, thus giving a false indication of the status of the barrel.

(2) With the machine gun barrel in a horizontal position, insert the breech bore gage into the chamber with the long side of the sleeve down. Make sure that the sleeve is fully seated in the chamber. When properly seated, the face of the recess in the head of the sleeve will be flush with the face of the barrel. In this manner any excessive length of the chamber, due to stretching or otherwise, will be indicated by the recess entering beyond the face of the barrel.

(3) Slide the gage inward until a definite contact with the lands of the barrel is felt. For convenience in reading, the gage should be rotated within the sleeve so that the figures are uppermost and opposite the long side of the sleeve. The erosion and wear of the lands will be indicated in inches by the index line opposite the end of the sleeve.

*c. Calibration.*—(1) When due to the erosion and wear of the barrel, the gage enters the sleeve to the red index line (2.0-inch), it indicates that the initial velocity has dropped approximately 200 foot seconds. The barrel may still be fired several thousand additional rounds; but balancing the additional firing of the barrel against accuracy, cost of ammunition, etc., indicates that the barrel had best be replaced.

(2) The approximate relation between the index lines on the gage and the number of rounds fired is as follows:

(a) The 0.5-inch mark indicates that 1,200 rounds have been fired and that the remaining effective life of the barrel is 2,000 rounds.

(b) The 1.0-inch mark indicates that 2,000 rounds have been fired and that 1,200 rounds additional may be fired.

(c) The 1.5-inch mark indicates that 2,500 rounds have been fired and that another 700 rounds' firing may be expected.

(d) The 2.0-inch mark (red) indicates that the barrel has been fired 3,000 or 3,500 rounds and that the practical life of the barrel is ended. The average barrel should be scrapped at this point.

(e) The 2.5-inch mark indicates that the barrel has been fired 3,700 rounds.

(f) The 3.0-inch mark indicates that the barrel has been fired 4,200 rounds.

(g) The 3.5-inch mark indicates that the barrel has been fired 4,700 rounds.

(h) The 4.0-inch mark indicates that the barrel has been fired well in excess of 5,000 rounds.

**NOTE.**—The foregoing approximations will vary, depending on the rate of fire, barrel, and other variables, but are a fair indication of the condition of the barrel.

**18. Headspace gaging.**—*a. General.*—The headspace of a machine gun with a cartridge fully seated in the chamber is the distance between the base of the cartridge and the face of the bolt. It is adjusted by obtaining the proper distance between the forward part of the bolt and the rear end of the barrel. Correct headspace adjustment is essential to proper functioning and proper shot patterns.

*b. Use of headspace and timing gage (A196228) for gaging headspace.*—This gage is issued to the using arm and services for all caliber .50 Browning machine guns, and is marked on the face **HEADSPACE**—.200, and **TIMING**—.116, and on the edge .50 BMG. There are two parts to the gage, one part being used for checking headspace and the other for checking timing.

(1) Headspace the gun in the manner prescribed for the particular weapon.

(2) Cock the firing pin.

(3) Retract the bolt slightly in order to relieve the pressure, caused by the driving spring, between the bolt and the end of the barrel.

(4) Then insert the gage in the T-slot between the face of the bolt and the end of the barrel. If the gun is headspaced too tightly, it will not be possible to enter the gage between the face of the bolt and the end of the barrel, and if such is the case, the barrel should be unscrewed one notch at a time from the barrel extension until the gage will enter.

(5) If the gun has been headspaced in the manner prescribed for the particular weapon, and if the headspace gage can be entered between the face of the bolt and the end of the barrel, the headspace

is correct. It must be clearly understood that the headspace gage is a "go" gage which was designed particularly for the purpose of checking guns in installations where tight headspace adjustment would cause serious trouble.

(6) However, the gage may be used to determine whether headspace is unnecessarily loose by screwing the barrel into the barrel extension one notch at a time until the gage will not enter and then unscrewing the barrel one notch so that the gage will enter.

**19. Checking timing.**—*a. Purpose.*—This check is for aircraft machine guns fired by synchronized solenoid or trigger motor only. The purpose of the check is to insure that the machine gun is not fired too early by the trigger motor or solenoid. In extreme cases of early timing, the gun will fire two shots and then stop because recoil from the second shot started before the extractor could engage another cartridge in the belt. It has been demonstrated that even when the time of firing is not so extremely early that the gun stops after firing two shots, firing may be early enough to cause inferior performance of the gun in lifting long ammunition belts.

*b. Procedure.*—(1) Check assembled gun and adjust headpiece if necessary.

(2) Cock the firing pin.

(3) Raise cover and retract the bolt slightly.

(4) Insert the gage in the space between the front of the barrel extension and the trunnion block with the curved end of the gage over the barrel.

(5) Allow the action to close slowly on the gage.

(6) With the action held open by the thickness of the gage, apply pressure to the trigger. It should not trip the firing pin.

**NOTE.**—In the case of aircraft machine guns, an attempt should be made to release the firing pin by means of the trigger motor or the solenoid, with the gage in place between the barrel extension and the trunnion block. If the firing pin is released the solenoid or trigger motor must be adjusted so that it will fail to release the firing pin when the gage is in place.

## SECTION III

## MAINTENANCE AND REPAIR

	Paragraph
Tools .....	20
General instructions.....	21
Burs on screw heads and smooth surfaces.....	22
Loose rear sight movable base pivot or tension spring stud.....	23
Loose rear sight fixed base.....	24
Front sight out of alinement.....	25
Water jacket.....	26
Cover extractor cam.....	27
Side plate.....	28
Bent trigger bar.....	29
Clogged steam tube.....	30
Bent belt feed lever or worn stud.....	31
Excessive play between sear and sear slide.....	32
Packing barrel.....	33
Mounts .....	34
Care, cleaning, and lubrication.....	35

**20. Tools.**—The general tools needed for maintenance and repair are listed in the Standard Nomenclature List pertaining to the matériel in question, and are part of the equipment of an ordnance maintenance company. Tools of a special nature are listed in Standard Nomenclature List A-35, and are carried by the small arms repair truck. Description of combination wrench M2 is given in paragraph 4.

**21. General instructions.**—*a.* The maintenance and repair of Browning machine guns, caliber .50, mounts and equipment covered in this manual are primarily a replacement of worn or broken parts, and such replacements are not covered in this manual. For detailed instructions in disassembling, assembling and changing parts, refer to the Field Manuals and Technical Manuals listed in the appendix.

*b.* Where parts or assemblies, or parts of assemblies are broken or worn so as to render them unserviceable, they must be replaced from stock. Often, only parts of assemblies will be worn or broken; where it takes more time to remove the serviceable parts from the assembly than the parts are worth, the assembly should be replaced.

*c.* In general, maintenance operations are of a first-aid nature, performed by qualified ordnance personnel with only the limited tool facilities afforded by repair trucks, or by semipermanent shops at posts and camps, or by an inspector while making a regular inspection. Typical operations in the maintenance of these guns are described below.

**22. Burs on screw heads and smooth surfaces.**—Remove burs from screw heads, threads, and like surfaces with a fine file. Remove

burs from smooth contacting surfaces with a fine grained sharpening stone. Polish rounded contacting surfaces with crocus cloth if necessary. Care should be observed to stone and file evenly and lightly and not to remove too much metal.

**23. Loose rear sight movable base pivot or tension spring stud (water-cooled guns).—**Remove rear sight movable base from fixed base. Remove rear sight fixed base screws. Turn base upside down with pivot or stud resting on a hardwood or lead block. Use a center punch to tighten pivot and/or stud in place.

**24. Loose rear sight fixed base (M1921A1 water-cooled guns).—**When the rear sight fixed base is found loose, it should be lifted by removing rear sight fixed base plate from top plate and the fixed base screws tightened from the under side. Replace fixed base and fixed base plate on top plate. Test functioning of movable base after repairing.

**25. Front sight out of alinement (water-cooled guns).—**Place gun on 1,000-inch target range having a target marked off with a vertical line 1 inch wide and 20 inches long. With the sight set at 700 yards and the windage on zero, aline guns on center of target and fire a burst of 10 rounds; if shots go to right of line, loosen front sight set screw, and turn front sight adjusting screw in a clockwise direction; if the shots go to the left of the line, the adjusting screw should be turned in a counterclockwise direction. Tighten front sight set screw, re-lay, reload, and fire. Repeat this operation until proper alinement is obtained.

**26. Water jacket (M1921 and M1921A1 water-cooled guns).—a.** When leaks are found in the water jacket, remove all component parts from the gun, steam tube included (see par. 30). With cold chisel make an alinement mark on top of the trunnion block or end cap, as the case may be. Clamp the gun at trunnion block in vise, using copper vise jaws. Heat the joint to be soldered by playing the flame of two blow torches on the joint. When little beads of solder begin to appear around the seam where the water jacket meets the trunnion, it is a sign that the parts are hot enough to unscrew. When proper heat is obtained, little force is needed to unscrew the water jacket. Clean the water jacket and trunnion block or end cap of all solder residue. Special care must be taken in cleaning these parts, as solder will not adhere properly to rusted or corroded metal, and the success of this work depends largely on getting these parts clean. In doing this work it is advisable to use a wire brush. When the threads are clean, screw on the water jacket by hand to find out how far the mark

on the water jacket screws past the corresponding alinement mark on the trunnion block. In order to have a tight joint, it is necessary to have  $\frac{1}{2}$  inch of dead draw. This draw is accomplished as follows: Unscrew the water jacket and peen the outside shoulder of the trunnion block or end cap. In doing this work care must be taken not to peen this shoulder too much. It is best to peen lightly all the way around the shoulder and then try the jacket. Repeat this until the desired draw is acquired. Any high spots caused by peening should be removed with a fine file having a safe edge. Tin the threads on water jacket and trunnion block or end cap, having parts hot enough to make solder flow smoothly. When threads of both are well coated with solder, clamp the gun at trunnion block in the vise. Heat the trunnion block just enough so that the solder will not run, and, before the trunnion block has a chance to get cold, heat the water jacket enough to soften solder and start to screw it on; keep the flame from two torches playing on the joint. Screw up to alinement mark. It may be necessary to strike the wrench with a hammer to screw up the water jacket so that the alinement marks meet. When leaks are due to porous metal or small seams, clean the surface with a fine file, or open seam slightly, and solder carefully with hard solder. Clean and paint surface affected to prevent rusting.

b. The above disassembly and assembly procedure does not apply to M2 guns, as the water jacket is not sweated on, and thread qualifications may be obtained by use of the trunnion block shim referred to in paragraph 3e.

c. In case damaged threads of reducing bushings necessitate replacement of bushing, heat with torch before attempting to remove as these bushings are usually sweated in.

**27. Cover extractor cam.**—When cover extractor cam is found broken, drill out cover extractor cam rivets, care being taken not to drill off center. Rivet new cover extractor cam in place and file rivets flush on top side. Test after repairing.

**28. Side plate.**—When the side plate at the backplate grooves is cracked, it should be straightened, using the old backplate as a guide. After straightening, the break or crack should be welded, and worn or missing parts should be replaced. Test action after repairing.

**29. Bent trigger bar (flexible gun).**—If trigger bar is sprung down, or there are burs on beveled face of trigger bar, or on sear, the gun may revert to uncontrolled automatic fire. In this case replace parts, or in emergency straighten bar and stone off burs. Test after repairing.

**30. Clogged steam tube.**—If inner steam tube is clogged, or outer steam tube fails to slide easily on inner tube, remove the assembly from the water jacket and disassemble and clean tubes; assemble and replace.

a. Stand water jacket in a vertical position with the front up. Remove the steam tube support lock screw and unscrew the front steam tube support until the threads are disengaged. Lower the front of the water jacket and the front steam tube support and steam tube will then slide out.

b. To replace, stand the water packet exactly vertical and insert the steam tube. Gently screw in the front steam tube support, stopping at once if there is any resistance. The water jacket and steam tube must be exactly vertical to insure that the end of the steam tube enters its seat in the rear steam tube support. Forcing the front steam tube against resistance will damage the threads or bend the steam tube. If it does not screw in easily, unscrew a short distance, be sure the water jacket is vertical, and try again until threads screw in smoothly. Screw in tight without excessive force and then position the notch in the rim of the front steam tube support exactly on the round countersunk recess for the steam tube support lock screw, unscrewing a part of a turn if necessary. Replace the steam tube support lock screw and screw it firmly down into its countersunk seat.

**31. Bent belt feed lever or worn stud.**—Excessive wear on lug on rear end of belt feed lever, belt feed lever pivot stud and front end of belt feed lever, or a bent belt feed lever will cause lost motion so that slide does not force cartridge fully to right (left) against stops. The extractor will hit rim of cartridge and drive bullet into case without engaging cannellure on base of cartridge. Replace parts, or in emergency in case of bent lever (if studs are not too worn), straighten lever. Test after repairing.

**32. Excessive play between sear and sear slide.**—If there is excessive play between the sear and sear slide and it cannot be corrected by interchange of sear and sear slide, it can be corrected by grinding off that portion of the sear that rests on the firing pin extension. In performing this operation great care should be taken to keep this surface level. It is best to grind off a little at a time and then try the sear and sear slide in the bolt. Be sure the sear slide does not bind on the sear. After proper fit has been obtained the parts should be smoothed off with a fine sharpening stone to remove any burs that may have been set up by grinding. Care should be taken to see that the outer edge of the sear slide is flush with the bolt and

that this edge of the sear slide is square and sharp in order to work properly with the trigger motor slide.

**33. Packing barrel.**—When necessary to repack the barrel proceed as follows:

*a. M2 water-cooled guns.*—(1) The packing used for these guns is formed asbestos cut to dimensions. Inside diameter of rear packing (ring) is  $1.45 \pm .010$ , A152638, and of front packing (ring) is  $1.575 \pm .010$ , A135710. Remove barrel assembly from gun before packing.

(a) *To pack breech end.*—Unscrew packing adjusting ring and remove old rear barrel packing. Clean recess in barrel and insert new rear barrel packing. Smooth barrel packing until ends meet. Screw packing adjusting ring against barrel packing to hold it in place.

(b) *To pack muzzle end.*—Unscrew front barrel bearing lock screw jam nut and front barrel bearing lock screw. Unscrew and remove muzzle gland. Remove muzzle packing ring and old front barrel packing. Clean out inside of front barrel bearing. Insert new front barrel packing and replace muzzle packing ring and muzzle gland. Screw muzzle gland lightly against ring and packing as the gland will be adjusted and locked in place after the barrel is reassembled in the gun.

(2) Reassemble barrel assembly into gun being careful not to injure barrel packing.

(3) Adjust front barrel packing (muzzle packing) by tightening or loosening muzzle gland, then lock in place with front barrel bearing lock screw and jam nut.

(4) Adjust rear barrel packing (breech packing) by tightening or loosening packing adjusting ring. A packing ring adjusting wrench and barrel holding wrench are provided for this purpose.

*b. M1921 and M1921A1 water-cooled guns.*—The packing used for these guns is asbestos yarn, 2-ply,  $\frac{1}{8}$ -inch, and should be well saturated with oil before use. Approximately 18 inches of packing (length) is needed for packing breech end of barrel, and 26 inches (length) for muzzle end of barrel.

(1) *To pack breech end.*—Remove barrel assembly from gun before packing. Place packing in cannellure and press home with screw driver and thumb. Wind it around, pressing up against the wall of the cannellure. As the end is crossed on the first turn see that it is bound down flat. On the last turn force the end under and see that it is bound down flat and worked in well. If the packing appears too thick, insert breech end of barrel into the hole in the trunnion block, push forward gently and twist barrel until the packing is worked down to fit.

(2) *To pack muzzle end.*—With the gun assembled, with or without the bolt, allow the bolt to go forward or trip the accelerator so that the barrel is fully forward. Remove the muzzle gland (M1921 gun) or muzzle radiator (M1921A1 gun). Wind the packing in even layers about the barrel with the first coil as close as possible to the end cap. Push back the muzzle or draw back and hold the bolt, at the same time guiding the packing into its seating. Screw in the muzzle gland or muzzle radiator, and test friction of the mechanism by releasing the bolt handle several times. If there appears to be too much friction, remove one or two coils of packing. The muzzle gland, or muzzle radiator, must be screwed up so that its shoulder is against the metal of the end cap, and not stopped by jamming against the packing.

**34. Mounts.**—*a. Burs on screw heads, cams, and smooth surfaces.*—Follow procedure outlined in paragraph 22.

*b. Loose head or shoe in leg (tripod M1).*—Remove loose rivets, replace and rivet.

*c. Burs on gear teeth (tripod and pedestal mounts M2).*—Remove burs on gear teeth with a sharpening stone (preferably) or fine file, and finish with crocus cloth if necessary. Care must be exercised to remove as little metal as possible.

*d. Damaged paint.*—Scrape surface lightly, clean thoroughly, and repaint. Surface must be bone dry before painting.

**35. Care, cleaning, and lubrication.**—For specific instructions covering care, cleaning, and lubrication of machine guns, mounts, and other matériel covered in this manual, see Field Manuals and Technical Manuals (pertaining to the gun) listed in the appendix.

*a. In Arctic climates.*—(1) Special care, cleaning, and lubrication of machine guns are necessary for their proper functioning in Arctic climates where extremely low temperatures are encountered. For proper materials for cleaning and lubrication in Arctic climates see TM 9-850 and SNL K-1.

(2) Antifreeze solution, ethylene glycol, is authorized for use in water jackets of machine guns for cold climates. It is satisfactory for temperatures as low as  $-60^{\circ}$  F. when mixed with water in the proper proportions. It is highly important that the proper proportions of ethylene glycol and water be maintained. Protection against freezing at temperatures as low as  $-62^{\circ}$  F. can be obtained with a mixture consisting of 60 percent by volume of ethylene glycol and 40 percent by volume of water. More or less water than this amount will give a freezing temperature above  $-62^{\circ}$  F., due to the peculiar characteristics of the mixture.

*b. Guns.*—(1) Machine guns, when not in use or when left outdoors, should be protected from the weather by tarpaulin or other suitable covers. If brought indoors the guns should be thoroughly and completely oiled *immediately*, because moisture condensing on cold metal in a warm room will cause rusting. After guns reach room temperature they should be wiped free of condensed water vapor and oiled again with sperm oil. Special care should be taken not to use excess oil. The parts are best oiled by wiping with a slightly oily cloth.

(2) Guns brought indoors *after firing* should be thoroughly and completely cleaned immediately with dry-cleaning solvent and oiled as above. After reaching room temperature the gun should again be wiped free from moisture (if any) and reoiled.

(3) Bores and chambers should be thoroughly cleaned after use with rifle bore cleaner, and immediately coated with sperm oil to prevent rust.

(4) Bores and chambers should be wiped free of oil before firing.

(5) Sperm oil has preservative as well as lubricating properties and care should be taken to use it wherever permissible. However, if sperm oil is not available, lubricating oil for aircraft instruments and machine guns may be used for short periods as a rust preventive. This oil has *limited* corrosion resistance.

(6) The following lubricating oils should be used:

(a) For all caliber .50 aircraft machine guns when firing in the air use lubricating oil for aircraft instruments and machine guns.

(b) For all caliber .50 machine guns when firing on the ground at air temperatures below 45° F., use lubricating oil for aircraft instruments and machine guns.

(c) For all caliber .50 machine guns when fired on the ground at air temperatures above 45° F., use sperm oil. If sperm oil is not available, use engine oil SAE 10.

*c. Mounts and other matériel.*—Mounts and other matériel should, in general, be similarly treated. For buffer oil in all caliber .50 machine gun mounts, under all service conditions, use lubricating oil for aircraft instruments and machine guns.

*d. Cleaning machine guns received from storage and preparing machine guns for storage.*—For proper method of cleaning machine guns received from storage see TM 9-226. For proper method of preparing machine guns for storage see TM 9-225 and 9-226.

## APPENDIX

## LIST OF REFERENCES

## 1. Standard Nomenclature Lists.

a. *Cleaning and preserving.*

Material, cleaning and preserving----- SNL K-1

Special oils and greases----- SNL K-2

b. *Gun matériel.*

Gun, machine, caliber .50, Browning, M1921, aircraft, fixed and flexible----- SNL A-20

Gun, machine, caliber .50, Browning, M1921, and M1921-A1, water-cooled, and mounts----- SNL A-2

Gun, machine, caliber .50, Browning, M2, aircraft, fixed and flexible-- SNL A-38

Gun, machine, caliber .50, Browning, M2, heavy barrel, fixed and flexible, and ground mounts----- SNL A-39

Gun, machine, caliber .50, Browning, M2, water-cooled, fixed and flexible, and mounts----- SNL A-37

c. *Repair.*

Tools, special repair----- SNL A-35

d. OPSI.—Current Standard Nomenclature Lists are as tabulated here. An up-to-date list of SNL's is maintained as the Ordnance Publications for Supply Index (OPSI).

## 2. Explanatory Publications.

a. *Cleaning and preserving.*

Cleaning and preserving materials----- TM 9-850

b. *Gun matériel.*

Browning machine gun, caliber .50, HB, M2, ground----- FM 23-60

Browning machine gun, caliber .50, HB, M2 (mounted in combat vehicles) ----- FM 23-65

Browning machine gun, caliber .50, M1921, aircraft, fixed and flexible----- TM 9-220

Browning machine gun, caliber .50, M2, aircraft, fixed and flexible-- TM 9-225

Browning machine gun, caliber .50, M2, water-cooled, and mounts--- TM 9-226

Marksmanship and service of the piece—antiaircraft machine gun-- FM 4-135

c. *Inspection.*

Matériel inspection and repair----- TM 9-1100

d. *Maintenance.*

Maintenance of matériel in hands of troops----- OFSB 4-1

[A. G. 062.11 (11-13-41).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,  
*Chief of Staff.*

OFFICIAL:

J. A. ULIO,  
*Major General,*  
*The Adjutant General.*

DISTRIBUTION:

D 1, 2, 7, 17 (4); B 1, 2, 4, 6, 7, 17 (2); IR 1, 7, 17 (5); IBn 9, 17 (2); IC 9 (4).

(For explanation of symbols see FM 21-6.)

